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IS CONTRACTUAL FLEXIBILITY ALWAYS GOOD FOR RELATIONSHIP QUALITY AMONG THE PARTIES IN CONSTRUCTION PROJECTS?

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Abstract. Contractual flexibility as an effective way to maintain and increase parties' relationship quality has been widely introduced to contracting in construction projects. However, conflicting evidences exist regarding their effectiveness on relationship quality based on transaction cost theory. Building on two distinct bases for contractual flexibility: content flexibility, rely on flexible content incorporated in initial contract content, versus executing flexibility, rely on parties' relationship instead of contract contents, this study examines how contractual flexibility effect relationship quality under different transaction attributes (asset specificity, environmental uncertainty, and behavioral uncertainty). Results from a sample of 312 parties reveal that content flexibility and executing flexibility positively influence relationship quality, with executing flexibility having a stronger association than content flexibility. Yet, important conditions exist. The moderating analysis demonstrates that when asset specificity or environmental uncertainty is high, executing flexibility, not content flexibility, matters more to relationship quality. In contrast, when behavioral uncertainty is high, content flexibility, not executing flexibility, matters more to relationship quality. These findings suggest that contractual managers should incorporate executing flexibility into contracts more sufficiently, and the appropriate contractual flexibility should match with transaction attributes.

Keywords: contractual flexibility, content flexibility, executing flexibility, relationship quality, transaction attributes, asset specificity, environmental uncertainty, behavioral uncertainty.

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1. Introduction

In construction projects, maintaining a high level of relationship quality among parties is crucial for fostering cooperation, improving performance, and maximizing project value (Williams et al., 2015; Wu et al., 2020). Relationship quality is a measure of the relationships among project stakeholders, reflecting the levels of trust, commitment, satisfaction, and teamwork among project parties (Jelodar et al., 2017; Lu & Guo, 2019). However, the construction projects are particularly characterized by uncertainty, with unforeseen contingencies that cannot be predicted before the project contracts are signed (Abdi & Aulakh, 2017; Hazır & Ulusoy, 2020). The relationship quality often declines when the parties experience uncertainty and perceive damage to their own benefits (Um & Kim, 2018; Zheng et al., 2019). Therefore, project contracts often include soft terms to enable their adaptability for uncertainty (Hu et al., 2021; Susarla, 2012; Xu et al., 2022). This allows parties to receive appropriate compensation based on the terms of contract, rather than engaging in opportunism behavior (Cruz & Marques, 2013; Demirel et al., 2017). In order to form the capability to respond to uncertainty rapidly and reasonably, the concept of flexibility is introduced into contracting (Nystén-Haarala et al., 2010; Song et al., 2018). Contractual flexibility provides a coping strategy for uncertainty based on the adjustment principles promised by the parties in the contracts (Feng et al., 2023; Kujala et al., 2015).

Scholars have confirmed that contractual flexibility plays a crucial role in maintaining relationship quality. According to Dong and Chiara (2010), setting appropriate flexibility in project contracts can help allocate risk to the party with greater competence to handle uncertainty, which in turn can lead to commensurate compensation based on the contract. This allows all parties involved to

undertake the risk of uncertainty (Cruz & Marques, 2013), resulting in a sustained relationship quality among parties over time (Demirel et al., 2017). However, recent research cautions about the potential dark side of contractual flexibility. Firstly, the flexible items and rights may also increase the possibility of opportunistic behavior or unethical behavior (Kosnik, 2014). Secondly, although adjusting the contract price due to uncertainty may be beneficial, it often results in at least one party feeling dissatisfied, leading to performance shading and relationship quality decline (Hart & Moore, 2008), such as business disruption in renegotiation (Susarla, 2012). Based on the research conducted by Fehr et al. (2015), it has been found that rigid contracts may be more efficient than flexible contracts in certain situations. Feng et al. (2023) compared rigid and flexible contracts for PPP projects, the presence of ex post renegotiation under flexible contract reduces the firm's ex ante effort, and the results also demonstrate that the firm profit under flexible contract is lower than rigid contract under special conditions. In conclusion, contractual flexibility has both advantages and disadvantages on relationship quality. Efficient contractual flexibility fails to be built into construction projects, so contract managers should consider how to realize and enhance the effectiveness of contractual flexibility.

There are two issues determining when contractual flexibility matters to relationship quality. First, different types of contractual flexibility will result in different influences on relationship quality. Contractual flexibility can be distinguished into content flexibility and executing flexibility, depending on when it is incorporated into the contract (Nystén-Haarala et al., 2010). These types of contractual flexibility are distinct constructs with different logics and decision rules (Hu et al., 2021; Xu et al., 2022). Content flexibility reflects that its function relies on flexible content incorporated in the initial contract documents, such as price flexibility, dispute resolution, renegotiation, and incentive mechanism (Athias & Saussier, 2010; Guo & Wang, 2022; Susarla, 2012). Executing flexibility shows that its function relies on the parties' relationship instead of contract contents (Hu et al., 2021; Yli-Renko et al., 2001), including ex-post revising the initial contract and independent administration to risk response (Song et al., 2018). Thus, the different realization ways of contractual flexibility may result in different results, it is necessary to explore the relationship between contractual flexibility and relationship quality from different categories.

Second, the drawing and executing process of contractual flexibility is sounded by the transaction attributes (Carson et al., 2006; Williamson, 1985), the appropriate level of contractual flexibility should correspond with specific transaction attributes (Feng et al., 2023; Fink et al., 2018). Three general and examined transaction attributes in projects are asset specificity, environmental uncertainty, and behavioral uncertainty. Previous studies rooted in transaction cost theory have demonstrated that the presence of transaction attributes increases the likelihood of opportunism or unethical behavior (Williamson, 1996; Cheng et al., 2014; Shi et al., 2018). Parties may breach construction contracts to achieve greater gains (Wu et al., 2017), leading to a decline in relationship quality. Consequently, transaction attributes exert negative effects on the relationship between contractual flexibility and relationship quality. However, the transaction attributes may also increase relationship quality between the parties in the projects. Specific assets can be viewed as relationship investments, rather than relationship expenditures, the parties will recognize a common identity and form a common goal, which bring closer the parties by virtue of enhancing relationship quality (Lui et al., 2009; Skarmeas & Robson, 2008). In high-uncertainty scenarios, when parties depend on their relational dynamics to address challenges (Yang & Cheng, 2020), the party experiencing a loss can receive fair compensation, ensuring that no single party bears an excessive burden due to uncertainty. Consequently, uncertainty may enhance the relationship between contractual flexibility and relationship quality (Fink et al., 2018). There is a limited amount of literature that explores the moderate effect of three transaction attributes on the effectiveness of different dimensions of contractual flexibility on relationship quality in projects.

This study contributes to bringing new insights into the effectiveness of contractual flexibility in the setting of construction projects. While prior studies have considered contractual flexibility as a valuable factor in construction projects (Cruz & Marques, 2013; Ding & Zhang, 2020; Domingues et al., 2014), this study distinguishes the different effectiveness between content flexibility and executing flexibility on relationship quality to explore how to realize and promote the effectiveness of contractual flexibility. In addition, this study explores the relationship between contractual flexibility and relationship quality by considering the moderate effect of transaction attributes. Thus, the research questions are as follows:

(1) How does each form of contractual flexibility affect relationship quality?

(2) How do the three transaction attributes moderate the interaction between content/executing flexibility and relationship quality?

In order to achieve the purpose of this study, in the second section, this paper reviews the theoretical background of contractual flexibility and transaction attributes in the setting of construction projects. In the third section, this paper proposes several hypotheses for the relationship between content flexibility/executing flexibility and relationship quality and the moderate effect of transaction attributes. In the fourth section, this paper presents the research method, data, and in the fifth section analysis of results. In the final section, this paper makes an in-depth discussion, forms a conclusion, and presents the managerial implications.

2. Theoretical background

2.1. Content flexibility versus executing flexibility

Contractual flexibility, however, has different bases. When contractual flexibility is needed, the flexibility elements can be incorporated into the contract during contract designing. Content flexibility refers to the rapid response ability of a contract to cope with uncertainty based on initial contract terms (Demirel et al., 2017; Susarla, 2012). Some parties transfer their possible future risks to other contractual parties who can deal with it more cost-efficiently, content flexibility helps the original risk-bearing parties mitigate the uncertainty to an acceptable level (Dong & Chiara, 2010). According to the designing of terms, content flexibility contains price flexibility (Tan & Yang, 2012), renegotiation mechanisms (such as duration delay, project suspension, and project termination) (Feng et al., 2023; Yoon & Yu, 2019), conflict protecting and solving mechanisms (Plambeck & Taylor, 2007), and incentive mechanism (Laan et al., 2011). With common clauses in major standard forms of contracts, the content flexibility perhaps presents through project delivery systems, pricing methods, alternative dispute resolution methods through arbitration, mediation, and dispute resolution boards, price escalation clauses, change order mechanisms. Also, the dangers of contract ambiguity can be addressed. All parties in the initial contract accept the adjusted principle of content flexibility because each party's responsibility-right-benefit is balanced. Therefore, content flexibility can provide some coping strategies for uncertainty rapidly and economically (Shahrara et al., 2017).

Others argue that flexibility can be incorporated into the contract at the time of contract executing, as they propose that the process of "contracting" will be implemented throughout the entire duration of the project (Kujala et al., 2015; Nystén-Haarala et al., 2010). Contracting not only contains the process of designing the contract content, but also contains the process of executing the contract content, because the safeguard and coordination function of the contract is realized in the second stage (Schepker et al., 2014; Yang & Cheng, 2020). Executing flexibility shows that its function relies on the parties' relationship instead of contract contents (Hu et al., 2021), on the basis, the party revises the contract when the initial contract terms are not reasonable, or no terms exist for emergencies and conflicts. For example, in the context of project business characterized by complexity and uncertainty, there is a need for parties to leave some decisions to a future date or to sign the contract with vague terms, and then revise it until there is adequate information for decision making (Kujala et al., 2015). The specific flexibility measures in the contractual executing process include ex-post revise the initial contract, independent administration to risk response and so on (Song et al., 2018; Xu et al., 2022).

Whereas the contractual flexibility features both content flexibility and executing flexibility in various styles in construction projects (Song et al., 2018; Wu et al., 2018). The two types of contractual flexibility are distinct constructs with different realized logics. Based on the initial contract, the main logic underlying content flexibility is risk and benefit sharing. When risk and uncertainty appear, the parties rapidly require appropriate compensation based on the contract's flexible principles and framework. However, there is a fact that not all contingencies can be foreseen in content flexibility, and not all flexible content is appropriate in the process of contract execution. Executing flexibility deals with these contingencies or conflicts that arise from uncertainty based on parties' relational capability. Content flexibility and executing flexibility jointly achieve the functionality of contractual flexibility through different logical mechanisms.

2.2. Transaction attributes in project management

According to previous research, the existence of transaction attributes increases the probability of opportunism behavior, and opportunism behavior threatens relationship quality among the parties in construction projects (Ortiz-González et al., 2018; Williamson, 1996). The three critical dimensions for characterizing transactions in construction projects are (1) Asset specificity, (2) Environmental uncertainty, and (3) Behavioral uncertainty (Fink & Harms, 2012; Pang et al., 2015).

Asset specificity in a construction project refers to the specialized investments made by one party that are uniquely tailored to the specific exchange and cannot be utilized for other purposes. All parties invest specific assets in this project, the optimal selection strategy for each party is to successfully complete this project. Otherwise, their respective assets would loss. There are four styles of asset specificity in projects: physical asset, human asset, dedicated, and temporal. Physical asset specificity is described as equipment, machinery, or materials customized to this project (De Vita et al., 2011). Human asset specificity represents the customized specific human resource of this project (Pang et al., 2015). Dedicated assets mean the asset is invested for this project and cannot be invested for other purposes (Chang & Ive, 2007), such as social capital in PPP projects. Temporal specificity represents the duration of one project specifically for all parties.

Uncertainty is distinguished into environmental and behavioral uncertainty (You et al., 2018). Environmental uncertainty in projects reflects the appearance rate and degree of unforeseen events surrounding projects over time (Fink & Harms, 2012; Zhou & Poppo, 2010). Behavioral uncertainty in construction projects refers to the degree to which one party is unable to accurately observe or evaluate the activities of other parties involved, we couldn't know whether the parties are conscientious or perfunctory (Um & Kim, 2018). It may result in two different results, such as perfunctory performance and consummate performance (Fehr et al., 2015).

2.3. Relationship quality

In construction projects, relationship quality is one of the key factors to measure the success of cooperative relationship (Williams et al., 2015). Relationship quality not only includes trust, commitment and satisfaction in the traditional sense, but also involves the interaction quality of project parties in the process of resource integration, risk sharing and collaborative innovation (Jelodar et al., 2017; Wu et al., 2020). Trust is regarded as an important mechanism to reduce information asymmetry and uncertainty. High levels of trust facilitate the sharing of key information among participants, increase the transparency of cooperation, and reduce conflicts and disputes during project implementation (Zheng et al., 2019). Commitment, as an important component of relationship quality, reflects the level of commitment to the project's goals and long-term cooperation. In engineering projects, long-term cooperation can form a stable bond of interests, which encourages participants to consider the overall project interests more in the face of risks and changes, rather than pursuing short-term partial benefits (Poppo et al., 2008a). In addition, relationship quality pays special attention to cooperation satisfaction and fairness. Cooperation satisfaction is not only influenced by the quality and efficiency of project deliverables, but also by the recognition and incentives received by all parties during the project process (Jelodar et al., 2017).

On this basis, several studies have begun to explore the potential influencing factors of relationship quality. The flexibility and adaptability of contract terms have a significant impact on the relationship quality. It is believed that contract flexibility can alleviate the impact of external uncertainties on project cooperation by providing an adjustment mechanism (Wu et al., 2020), help all parties to better deal with uncertainties, and thus maintain a high relationship quality (Ding & Zhang, 2020). However, excessive contractual flexibility can also lead to opportunistic behavior that compromises relationship quality (Feng et al., 2023). Transaction attributes such as asset specificity, environmental uncertainty and behavioral uncertainty have important effects on relationship quality. High asset specificity may lead to opportunistic behavior, but through good relationship management can translate into enhanced cooperative relationships (Lui et al., 2009). their impact on relational quality is highly contingent upon who makes specific investments and the compensation for any contractual changes. Similarly, the impact of uncertainty depends on whether the contract contains explicit compensation clauses to mitigate risk (Wu et al., 2020). Environmental uncertainty requires greater adaptability and willingness to cooperate among parties to maintain relationship quality (Fink & Harms, 2012). Behavioral uncertainty needs to be managed through trust and incentive mechanisms (Um & Kim, 2018). In addition, relationship quality maybe also affected by other factors, such as expectation continuity (Chen et al., 2018), prior collaboration experience (Lorenz & Veer, 2019), project duration and project complexity (Hu et al., 2023; Zhang et al., 2022).

In the next section, we will examine how content/executing flexibility influences relationship quality and how these transaction attributes moderate the effects.

3. Hypotheses development

3.1. Effects of contractual flexibility on relationship quality

Due to the increasing uncertainty of construction projects, content flexibility is viewed as an effective tool for dealing with emergencies and improving the quality of relationships among parties. The risk of uncertainty can be allocated to the party who has the capacity to undertake and resolve the uncertainty, and the party can achieve reasonable compensation based on contractual flexibility (Dong & Chiara, 2010). As a result, the relationship quality among the parties will remain over time within change and complex uncertainty (Demirel et al., 2017). Above all, this study proposes the effect of content flexibility on relationship quality is positive.

Hypothesis 1a: Content flexibility is positively associated with relationship quality.

Content flexibility maybe not appropriate due to the drawing cost of flexible contracts and the bounded rationality of contract managers, the function of flexible terms is limited. In this situation, executing flexibility is necessary. The significance of executing flexibility through relational norms and behaviors has been highlighted in project management. According to Serrador and Turner (2015), effective project management relies on high levels of interaction, collaboration, responsiveness, and joint problem-solving during the project management process. Meanwhile, Davis et al. (2014) found that cooperation, collaboration, consultation, and communication all loaded together as a success factor in their empirical study. The relational elements, such as joint problem solving, communication, usually appear in executing flexibility due to the initial contract is not explained in detail or is not appropriate. Therefore, we predict that:

Hypothesis 1b: Executing flexibility is positively related to relationship quality.

3.2. Moderation role of transaction attributes

3.2.1. Asset specificity

While the association of contractual flexibility with relationship quality is well documented when contractual flexibility is distinguished into content flexibility and executing flexibility, it is unclear how asset specificity moderates the relationship quality.

Based on transaction cost theory, the parties have invested specific and customized assets for this project (Shi et al., 2018). If one party abandons this project, other parties' benefits are damaged because they must search for a

new cooperation party, and the project duration exceeds expectations. The transaction cost is greater than the punishment of the party who break the contract. Even though all parties perceive a well-structured system of rewards and punishments in content flexibility, incentives are misaligned because the incentive terms are incomplete, and the punishment is less than the loss of the project. It is common for project parties to seek their own self-interests by focusing on asset specificity (Hoetker & Mellewigt, 2009; Wang et al., 2009). Thus, relationship quality may decline when one party realizes that they can engage in opportunistic behavior without facing significant consequences.

Hypothesis 2a: The positive relationship between content flexibility and relationship quality weakens as asset specificity increases.

In contrast to content flexibility, when executing flexibility exists, trust, communication, commitment, and cooperation are the basis for executing flexibility in projects; all parties recognize a common identity and form a common goal for the projects (Lui et al., 2009; Poppo et al., 2016). The recognized common identity changes the meaning of asset specificity: the parties fully take advantage of asset specificity through cooperation instead of opportunistic behavior, and the common goal enhances the citizenship behavior of the parties to cope with uncertainty (Lui et al., 2009; Skarmeas & Robson, 2008). Thus, executing flexibility redefines asset specificity as a reliable guarantee to project cooperation, not a possibility for opportunism behavior. Particularly, when the project faces unpredicted risk, the parties recognize that the benefit of the project is prior to self-interest. They consider other parties' benefits before they make the decision. For instance, if contractors consider the other parties' trouble and loss when facing uncertainty and suggests a decision that is optimal for all parties instead of the maximum of his self-benefit, the relationship quality arises, and the other party will also return for the cooperation in next time. When asset specificity is high and there is a focus on executing flexibility, the value of the project may be increased. Conversely, when asset specificity is low, there may be a lack of organizational identification in terms of executing flexibility.

Hypothesis 2b: The positive relationship between executing flexibility and relationship quality strengthens as asset specificity increases.

3.2.2. Environmental uncertainty

Contractual flexibility is more valuable when uncertainty exists (Bstieler & Gross, 2003; Heeley et al., 2006). Under conditions of low environmental uncertainty, the adjustment principles are discussed and agreed upon prior to contracting for content flexibility. The parties can effectively deal with uncertainty by relying on content flexibility. As a result, the relationship quality among the parties will be maintained due to the rapid and economical response style. If uncertainty is taken as an assumption rather than as a threat, it could be used as an opportunity through contractual flexibility (Cruz & Marques, 2013). However, content flexibility realizes its function through writing the adjustment terms in contract content, which make it difficult because the contract managers are bounded rationality and the cost of concluding a bargain is high, so content flexibility cannot respond to any uncertainty. In practice, the environment of the projects is unpredictable and changing, thus, when the level of environmental uncertainty is high, the parties cannot respond to uncertainty rely on content flexibility or the adjustment principle is unreasonable in this condition. For example, the emergence of the COVID-19 pandemic caused significant losses to contractors in terms of project timelines and costs. However, such an uncertain event as the pandemic was difficult to anticipate at the initial contract stage, making it challenging to obtain reasonable compensation based solely on contractual provisions. It leads to the parties adopting defensive actions and reducing their initial planned efforts in the projects (Luo, 2006), and the relationship quality declines. Furthermore, according to the flexible price based on different states in contract content, the parties may adopt some measures to maximize their self-interest instead of maximizing the value of this project (Lu et al., 2016).

Hypothesis 3a: The positive relationship between content flexibility and relationship quality weakens as environmental uncertainty increases.

When the environment is highly uncertain, content flexibility may result in performance shading or relationship quality reduction. Fehr et al. (2015) and Feng et al. (2023) suggest that a flexible contract is not always good than a rigid contract. Specifically, it is sometimes preferable for parties to draft a rigid contract and then revise it ex-post if necessary, rather than anticipating and including future contingencies in a flexible contract from the start, because the agreement in the initial contract may be unreasonable, and unreasonable results will lead to unfair perception of the parties. In project management, an ex-post revised contract is contained in executing flexibility, so when environmental uncertainty is high, the executing flexibility will be more valuable for the parties. Based on the above, the parties will solve the problems caused by uncertainty by executing flexibility.

Hypothesis 3b: The positive relationship between executing flexibility and relationship quality strengthens as environmental uncertainty increases.

3.2.3. Behavioral uncertainty

In construction projects, due to the parties being from different organizations, the different organizational cultural background makes it hard to understand the partner's behavior (Teraji, 2008). Thus, observing the party's behavior, such as in-role or extra-role behavior, is challenging (Fu et al., 2015). When behavioral uncertainty is high, observing the inputs or activities is challenging. However, with content flexibility, the party's final performance (time, quality, cost, safety) is evaluated in the contract, and

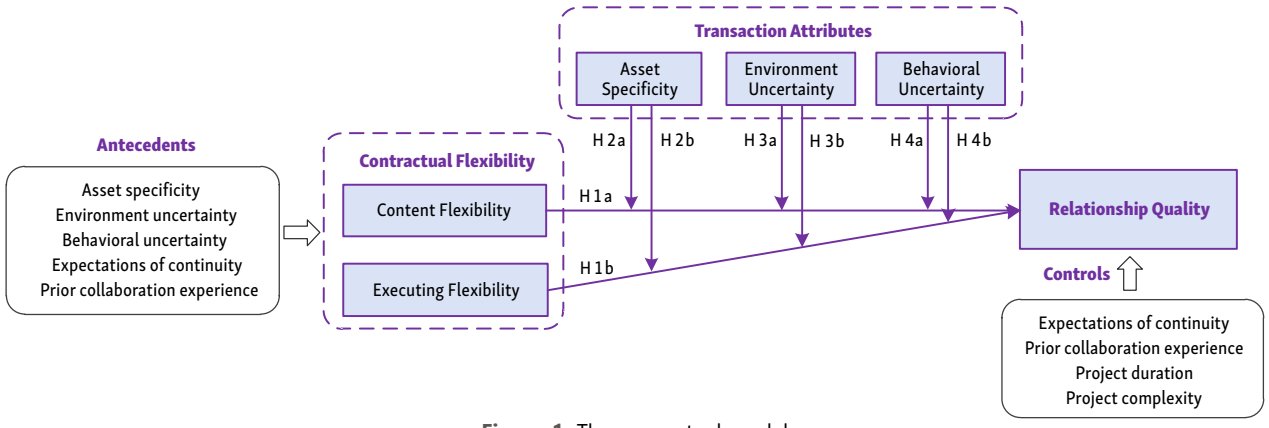

Figure 1. The conceptual model

awards and sanctions can be appropriately applied. The motivation structure encourages the party to construct this project effectively. For example, if one party provides several suggestions to reduce the project cost, the benefit saved could be allocated to the party in a certain percent. This motivation content encourages the parties to use their professional knowledge to construct this project.

Hypothesis 4a: The positive relationship between content flexibility and relationship quality strengthens as behavioral uncertainty increases.

We also predict that executing flexibility is more valuable when behavioral uncertainty is high. Although behavioral uncertainty may heighten the likelihood of opportunistic behavior without the constraint of contract content (You et al., 2018), executing flexibility emphasizes that the parties respond to the uncertainty relying on the trust, commitment, and communication between the parties. Thus, if behavioral uncertainty is viewed as an opportunity rather than a threat, it promotes the parties to communicate, cooperate and work together to resolve the problems (Ling et al., 2014). They will construct good relationship quality with other parties and realize their value in the project. Thus, executing flexibility is more effective at high levels of behavioral uncertainty.

Hypothesis 4b: The positive relationship between executing flexibility and relationship quality strengthens as behavioral uncertainty increases.

Figure 1 summarizes our conceptual model.

4. Method

4.1. Survey instrument and process

There are two continuous study stages in the research. First, in order to explore and verify the understanding of the conducts: content flexibility, executing flexibility, asset specificity, environmental uncertainty, and behavioral uncertainty, specialist interviews and a pilot survey were performed. Second, to collect experimental data to examine the hypothesis suggested, we conducted a large-scale questionnaire survey of project professionals in the construction industry.

We collected the data from China; the reasons are as follows: (1) As one of the largest construction markets in the world, China's scale and complexity provide a unique and ideal data source for testing the conceptual model of how contractual flexibility impacts relationship quality. (2) China, as a typical relationship-based society, places significant emphasis on the role of relationships and trust in construction projects. Additionally, in recent years, China has made continuous improvements in its contractual systems and project management practices. This distinctive institutional and cultural background offers a robust practical foundation for studying the mechanisms through which contractual flexibility influences relationship quality.

Specifically, our data covers Mainland China, Hong Kong, Macau, and Taiwan, where the contractual systems differ from those in Mainland China. However, regardless of the contractual system, all contracts include contractual flexibility, meaning that both content flexibility and executing flexibility are present. Additionally, the language and culture across these regions are similar, ensuring that the final conclusions are not influenced by regional differences.

4.2. Sampling and data collection

This study conducted semi-structured, in-depth interviews with 20 experts worked in construction contract management fields, including five professors, ten project managers, and five contract managers. The time of each interview varied from 30 to 50 minutes. The purpose was to conduct an in-depth exploration of the constructs of contractual flexibility and to demonstrate whether the hypothesis was correct. In addition, this study conducted a pilot test in a project training program and collected 49 completed questionnaires. These interviews and the pilot survey helped the authors understand the practice meaning of contractual flexibility and transaction attributes and achieve valuable suggestions for the measure items in the questionnaires.

The data of all the latent variables were collected from parties via opinion survey questionnaires. The potential respondents are the major parties in construction projects, such as owners, project managers, contract managers, su-

pervision engineers, and so on. These parties have a good understanding of contractual flexibility. The respondents were asked to choose a project they were working on and answer questions about content flexibility, executing flexibility, asset specificity, environmental uncertainty, behavioral uncertainty, and relationship quality. Because of the possibility of bias, the questionnaire does not ask for the respondents' or projects' names and includes a declaration informing them that their information is confidential.

Due to restricted direct access to target respondents and their reluctance to spend time responding to questionnaires, random sampling in the Chinese construction industry frequently results in a low response rate (Wu et al., 2015). As a result, this study adopted the non-probability convenience sampling method, an excellent way to increase response rates and is commonly used in the construction sector (Etikan et al., 2016). We participated in an international cooperation forum of the Global infrastructure project forum held by Tianjin University in November 2020. We collected the questionnaires through direct interactions with the attendees from various companies nationwide. We sent out 133 questionnaires and received 127 questionnaires. Then, we removed four invalid surveys and finally obtained 123 questionnaires. In addition, 189 valid questionnaires were collected from 10 construction industry practitioners with good cooperation relationships with our research team. This response sample size adheres to the rule of thumb that the minimum sample size should be ten times the maximum number of pathways aiming at any construct, the minimum sample size for this study is $10 \times 8 = 100 < 312$. Furthermore, the diverse sample sources ensured a diverse range of respondents and projects identified, improving the representation of the response samples. Profile for respondents in the questionnaires-based survey is presented in Table 1.

Table 1. Characteristics of respondents and their projects

Categories	Number	Percentage
Years in current position		
1–3 years	28	9.0%
4–8 years	117	37.5%
9–14 years	105	33.6%
≥ 15 years	62	19.9%
Position		
Contractor	195	62.5%
Owners	72	23.1%
Consultants	33	10.6%
Others	12	3.8%
Project type		
Housing	86	27.6%
Road and bridge	73	23.4%
Port and waterway	30	9.6%
Telecommunication	44	14.1%
Industrial	64	20.5%
Others	15	4.8%

As Table 1 shows, more than half of the respondents have ≥ 9 years of work experience, which indicates that respondents are experienced and quite qualified for the survey. Furthermore, most respondents are contract parties, indicating their good knowledge of contracts. Moreover, the sample is representative in terms of project type.

4.3. Measures

Contractual flexibility

Contractual flexibility contains two dimensions: content flexibility and executing flexibility. Two scales have been developed and verified (Song et al., 2018; Wu et al., 2018). However, some differences exist between the two scales. In this paper, executing flexibility reflects the degree of a willingness to rely on the relationship as a substitute for adapting to changes (Yli-Renko et al., 2001), so the measure scales developed by Song et al. (2018) is more appropriate in this study. The first 12 items measured content flexibility from four aspects: price flexibility, renegotiation, dispute protecting and solving, and incentive mechanism. The final 6 items measured the contractual executing flexibility based on the importance of formal contracts and the proportion of informal contracts used.

Asset specificity

This study adopted and modified a four-item scale from Carson et al. (2006), and Shi et al. (2018) to suit our research context. These items captured asset specificity in humans, equipment, materials, time, and efforts.

Uncertainty

Considering the features of the construction projects, this study used three items to measure environmental uncertainty developed by the studies of Chen et al. (2013) and Long et al. (2014). Referring to the work of Zhou and Poppo (2010), this study adapts three items of behavioral uncertainty to fit the context after wording modifications.

Relationship quality

Relationship quality in the research reflects how a relationship is evaluated regardless of the contract type and working arrangements. To measure relationship quality, a four-item scale from Jelodar et al. (2017) from four aspects: trust, performance satisfaction, commitment, and teamwork.

Control variables

Corresponding to previous research, this study considered four control variables. (1) Expectation continuity. Considering opportunities for future cooperation with the parties, the relationship quality among the parties may be maintain when some conflicts exist when facing uncertain. Therefore, expectation of continuity was tested with one item reflecting the extent to which the parties expected to have further cooperation in the future (Chen et al., 2018). (2) Prior collaboration experience. Previous coop-

eration has a negative relationship with the perception of opportunistic behavior (Lorenz & Veer, 2019). The number of times the partner collaborated prior to contracting for this project was used to measure it (Zollo et al., 2002). (3) Project duration. The longer the duration of the project, the more risks will be exposed during the implementation of the project, which will challenge relationship quality among the project parties. (4) Project complexity. Previous studies have shown these influences between project complexity and relationship quality (Hu et al., 2023; Zhang et al., 2022). It is measured by three items adapted from Tyssen et al. (2014). Because the stems in their study contain the content complexity, environment complexity, and organization complexity (Bosch-Rekveldt et al., 2011).

The multi-item scales of variables were adapted or developed from the relevant literature. This study measured all items by a five-point Likert scale (1 = strongly disagree; 5 = strongly agree).

4.4. Three-stage least squares analysis

In our model, content flexibility (CF) and executing flexibility (EF) are likely to be endogenous. Transaction attributes may increase the likelihood of parties engaging in uncooperative, opportunistic, or inefficient behavior (Williamson, 1996), thereby threatening relationship quality. In response, managers "select" appropriate governance mechanisms to safeguard transactions. Thus, the proper model specification should include transaction attributes as the antecedents of content flexibility and executing flexibility: asset specificity (AS), environmental uncertainty (EU), and behavioral uncertainty (BU). Similarly, prior collaboration experience (PCE) could provide insight into the magnitude of the adjustment costs resulting from ex-post negotiation for contractual flexibility (Gil & Marion, 2013). Expectations of continuity (EC) could play a positive role in the smooth implementation of flexible contracts (Lai et al., 2008; Poppo et al., 2008a). To correct for this potential endogeneity, we used a three-stage least squares analysis (Hamilton & Nickerson, 2003; Poppo et al., 2016; Zhou et al., 2014).

In Stage 1, we regressed two types of contractual flexibility against AS, BU, EU, PCE, and EC to obtain predicted values of content flexibility and executing flexibility. We then obtained residuals that were free of influence from asset specificity, environmental uncertainty, behavioral uncertainty, prior collaboration, and expectation of continuity, as specified in Eqns (1) and (2):

$$CF = b_0 + b_1(AS) + b_2(EU) + b_3(BU) + b_4(PCE) + b_5(EC) + e$$
$$\text{to obtain } CF_{residual} = CF - CF_{predicted}; \quad (1)$$

$$EF = b_0 + b_1(AS) + b_2(EU) + b_3(BU) + b_4(PCE) + b_5(EC) + e$$
$$\text{to obtain } EF_{residual} = EF - EF_{predicted}. \quad (2)$$

In Stage 2, we used $CF_{residual}$ and $EF_{residual}$ as the indicators of CF and EF, respectively, as specified in Eqn (3). That is, we regressed performance against $CF_{residual}$ and $EF_{residual}$ and the controls.

$$Relationship\ quality = b_0 + b_1(CF_{residual}) + b_2(EF_{residual}) + b_{controls}(Controls) + e. \quad (3)$$

In Stage 3, we added interaction terms to test the moderating effects. We assessed the effect of each moderator by adding interactions stepwise and testing the full model in Eqn (4):

$$Relationship\ quality = b_0 + b_1(CF_{residual}) + b_2(EF_{residual}) + b_{controls}(Controls) + c_1(CF_{residual} \times AS) + c_2(EF_{residual} \times AS) + c_3(CF_{residual} \times EU) + c_4(EF_{residual} \times EU) + c_5(CF_{residual} \times BU) + c_6(EF_{residual} \times BU) + e. \quad (4)$$

5. Analysis and results

5.1. Construct reliability and validity

The results of the confirmatory factor analysis were performed in Appendix Table A1. All the standardized factor loading (SFL) values are more than 0.6. All average variance extracted (AVE) values are above 0.50, and the square root of each construct's AVE was above its corresponding value (Poppo et al., 2016). These results indicated that the measurement model satisfied the item composite reliability and construct validity criteria.

In order to test the reliability of measure items in this questionnaire, exploratory factor analyses (EFA) in SPSS 18.0 were conducted to assess whether each measured item is relational. As shown in Appendix Table A, Cronbach's α values were all above 0.70 (Zhang & Qian, 2017), representing that these questionnaire items have satisfactory internal consistency and reliability.

5.2. Common method bias

Since the questionnaire items in this study were completed by the same respondents, there is a possibility of common method bias. To address this, we employed multiple methods to test for its presence (Kock, 2015; Podsakoff et al., 2024).

First, we conducted Harman's single-factor (HSF) technique to assess the impact of common method bias. The results showed that more than one principal component was extracted without rotation, with the first principal component explaining 35.647% of the variance. This proportion is below the critical threshold of 50%, indicating that common method bias does not significantly affect the results of this study.

Second, we employed the marker variable (MV) technique for additional validation (Lindell & Whitney, 2001; Podsakoff et al., 2024). Using the lowest correlation coefficient (–0.002) in Table 2, we calculated the partial correlation coefficients for each variable and conducted T-tests. None of the significant correlations was insignificant after this adjustment, indicating that common method bias has minimal impact on this study.

Finally, the full collinearity assessment method was used for addressing common method bias (Kock, 2015).

Table 2. Basic descriptive statistics of the constructs

Variable	1	2	3	4	5	6	7	8	9	10
AS		0.060	−0.052	0.054		−0.304	0.331	−0.064	−0.015	−0.064
2. EU	0.058		−0.042	0.044	0.048	0.740	0.551	0.172	0.020	0.065
3. BU	−0.054	−0.044		−0.121	−0.012	0.174	0.199	−0.038	−0.072	−0.040
4. PCE	0.052	0.042	−0.123*		−0.053	0.349	0.486	−0.060	−0.025	−0.037
5. EC	−0.002	0.046	−0.014	−0.055		0.392	0.505	−0.039	0.007	−0.030
6. CF	−0.306**	0.738**	0.172**	0.347**	0.390**		0.742	0.101	−0.004	0.023
7. EF	0.329**	0.549**	0.197**	0.484**	0.503**	0.740**		0.042	−0.021	−0.047
8. RQ	−0.066	0.170**	−0.040	−0.062	−0.041	0.099	0.040		0.569	0.614
9. PC	−0.017	0.018	−0.074	−0.027	0.005	−0.006	−0.023	0.567**		0.806
10. PD	−0.066	0.063	−0.042	−0.039	−0.032	0.021	−0.049	0.612**	0.804**	
Mean	5.226	5.2906	5.1389	5.22	5.25	3.9642	5.2078	5.0593	4.80	5.69
SD	0.615	0.980	0.661	1.019	1.021	0.535	0.394	0.981	1.070	0.880

Note: N = 312, *p < 0.05, **p < 0.01. Below the diagonal is the zero-order correlation; above the diagonal is the correlation adjusted for potential common method variance with the MV marker technique.

The Variance Inflation Factor (VIF) for all variables ranged between 1.232 and 2.455 (as shown in Appendix Table A1), which is below the threshold of 3.3. This demonstrates that this current study is free from the interference of common method bias.

In summary, the results from these three methods collectively demonstrate that common method bias does not significantly influence the findings of this study.

5.3. Construct model test

The results in Stage 1 (see Table 3) indicated that content flexibility was significantly related to asset specificity (b = −0.193, p < 0.05), environmental uncertainty (b = 0.208, p < 0.01), behavioral uncertainty (b = 0.150, p < 0.05), prior collaboration experience (b = 0.222, p < 0.01), and expectations of continuity (b = 0.165, p < 0.01), executing flexibility was significantly related to asset specificity (b = 0.169, p < 0.01), environmental uncertainty (b = 0.240, p < 0.01), behavioral uncertainty (b = 0.222, p < 0.01), prior collaboration experience (b = 0.175, p < 0.01), and expectation of continuity (b = 0.190, p < 0.01). These results supported the utilization of the three-stage model to control for the potential endogeneity of content flexibility and executing flexibility.

Stage 2 used $CF_{residual}$ and $EF_{residual}$ as the indicators of CF and EF, the results were indicated as M2 in Table 4. Table 4 shows the regression result.

Stage 3 added interaction terms to test the moderating effects We assessed the effect of each moderator by adding interactions stepwise as in M4 (in Table 4) and testing the full model in Eqn (4). According to the collinearity in product terms, we mean-centered the variables before we constructed the interaction terms (Aiken & West, 1991). In order to avoid the multicollinearity of the variables, we checked for multicollinearity by using the variance inflation factors (VIF) related to each variable in our models. The highest value of these factors is 4.675, which is below the 10.0 benchmark, so multicollinearity didn't exist in this questionnaire survey.

Table 3. Standardized estimates of Stage 1 in regression analyses

Independent variables	Content flexibility	Executing flexibility
Asset specificity	−0.193*	0.169**
Environmental uncertainty	0.208**	0.240**
Behavioral uncertainty	0.150*	0.222**
Prior collaboration experience	0.222**	0.175**
Expectation of continuity	0.165**	0.190**
Adjusted R^2	0.975	0.937
Highest VIF	1.022	1.022
Model F	10.23	18.22
DF	5657	5657

Note: **p < 0.01, *p < 0.05. High VIF = High Variance Inflation Factor.

5.4. Hypotheses testing

As Model 2 in Table 4 shown, both content (b = 0.268, p < 0.01) and executing flexibility (b = 0.335, p < 0.01) positively related to relationship quality, in support of H1a and H1b. Executing flexibility is more strongly associated with relationship quality than content flexibility.

We used the full model (M4 in Table 4) to test the interaction hypotheses. Hypothesis 2 assesses the moderating role of asset specificity. The interaction effect of content flexibility × asset specificity is negative (b = −0.289, p < 0.01), and that of executing flexibility × asset specificity is positive (b = 0.166, p < 0.01). These findings support H2a and H2b.

Hypothesis 3 examines the moderating effect of environmental uncertainty. The interaction effect of content flexibility × environmental uncertainty is negative (b = −0.305, p < 0.01), and that of executing flexibility × environment uncertainty is positive (b = 0.556, p < 0.01), supporting H3a and H3b.

Table 4. Standardized estimates of regression analyses

Independent variables	Relationship quality			
	M1	M2	M3	M4
Control variables				
Expectation of continuity	0.146	0.224	0.219	0.133
Prior collaboration experience	0.318	0.248	0.256	0.349
Project complexity	−0.155	−0.164	−0.169	−0.180
Project duration	−0.102	−0.154	−0.157	−0.219
Direct effects				
CF		0.268**	0.306**	0.292**
EF		0.335**	0.754**	0.627**
AS			0.082	0.029
EU			0.060	0.003
BU			0.082	−0.013
Interactions				
AS×CF				−0.289**
AS×EF				0.166**
EU×CF				−0.305**
EU×EF				0.556**
BU×CF				0.314**
BU×EF				0.320
Adjusted R^2	0.481	0.662	0.686	0.985
R^2 change	0.474	0.656	0.677	0.984
Highest VIF	4.355	4.529	4.588	4.675
Model F	13.33	15.66	15.88	15.69
DF	12344	13043	13546	13546

Note: **p < 0.01, *p < 0.05.

Hypothesis 4 examines the moderating effect of behavioral uncertainty. The interaction effect of content flexibility × behavioral uncertainty is positive (b = 0.314, p < 0.01), and that of executing flexibility × behavioral uncertainty is insignificant (b = 0.320, p > 0.05). These findings support H4a, but not H4b.

We performed simple slope tests for significant interactive factors in accordance with Aiken and West's (1991) method to acquire greater understanding of the interaction effects.

For H2a and H2b, as is shown in Figure 2, we split the partners' asset specificity variable into two groups – low (one standard deviation below the mean) and high (one standard deviation above the mean) – and estimated the effect of content/executing flexibility on performance for both levels. We find that content flexibility is strongly related to relationship quality when asset specificity is low (simple slope b = −1.040, p < 0.05), but not when it is high (b = −1.39, p < 0.05). Executing flexibility is not specificity related to relationship quality (b = 1.392, p < 0.01) when asset specificity is low but is positively related to relationship quality when it is high (b = 1.598, p < 0.01). These results suggest that content flexibility works better when asset specificity is low, whereas executing flexibility is more effective when it is high.

For H3a and H3b, as shown in Figure 3, content flexibility is strongly related to relationship quality when environmental uncertainty is low (b = 3.19, p < 0.01). This effect is weaker when it is high (b = 0.22, p < 0.01). This result indicates that when environmental uncertainty is low, parties can effectively manage uncertainty by utilizing content flexibility, leading to a high relationship quality. However, as environmental uncertainty rises, parties are unable to rely on content flexibility to address uncertainty, making the adjustment principle impractical. This often results in parties taking defensive actions and reducing their initial project efforts, ultimately leading to a decline in relationship quality. The effect of executing flexibility is significantly positive when environment uncertainty is high (b = 0.23) but is insignificant when environmental uncertainty is low (b = 3.88, p < 0.01). These findings indicate that content flexibility is more effective when market uncertainty is low, whereas executing flexibility works better when it is high.

For H4a, as is shown in Figure 4, content flexibility relates more strongly to relationship quality when behavioral uncertainty is high (b = 1.699, p < 0.01) than when it is low (b = 2.113, p < 0.01). This finding indicates that content flexibility is more effective when behavioral uncertainty is high than when it is low.

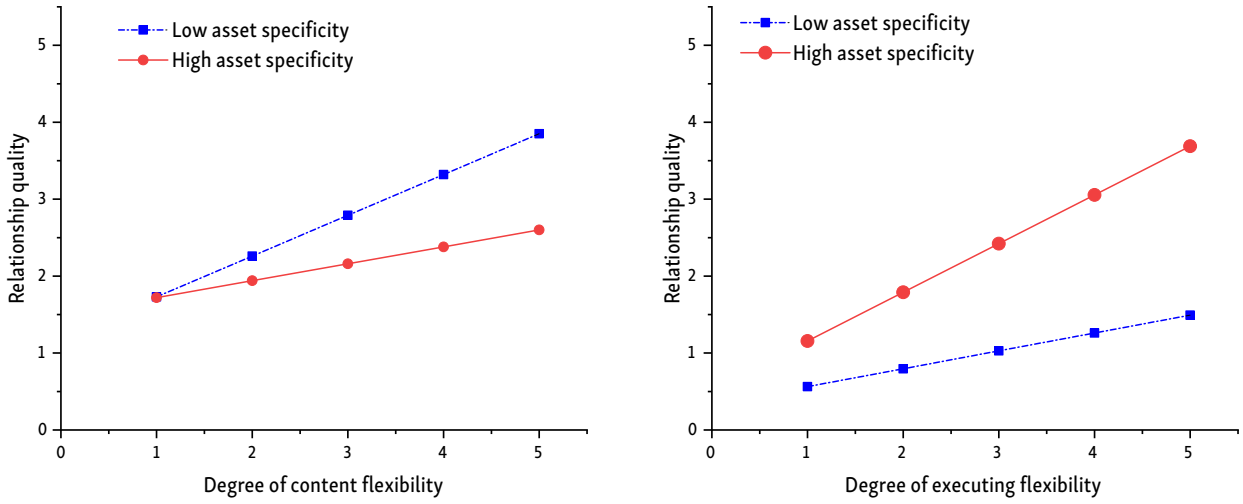

Figure 2. Graphical moderating representation of asset specificity

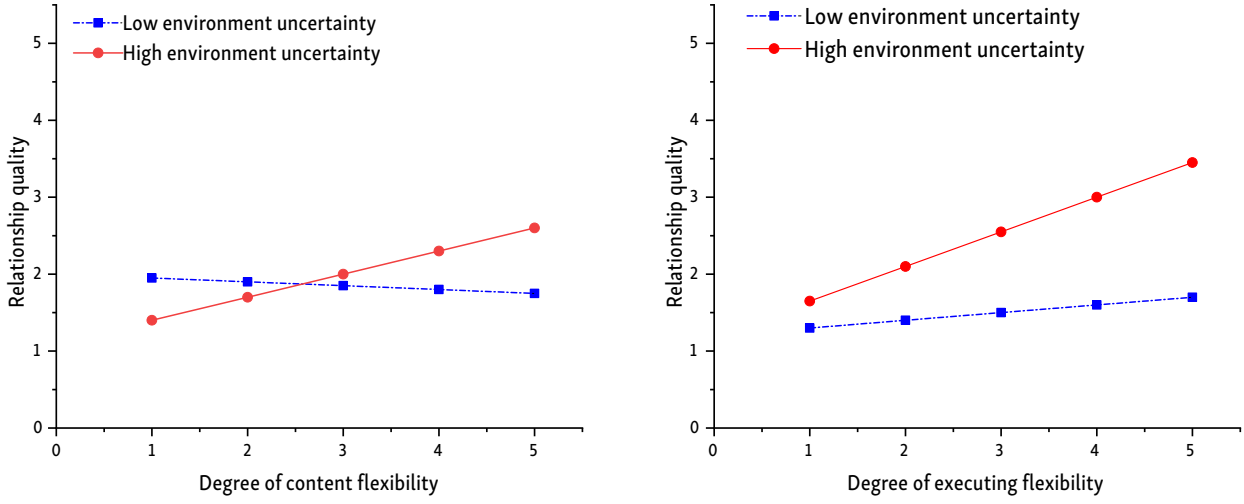

Figure 3. Graphical moderating representation of environmental uncertainty

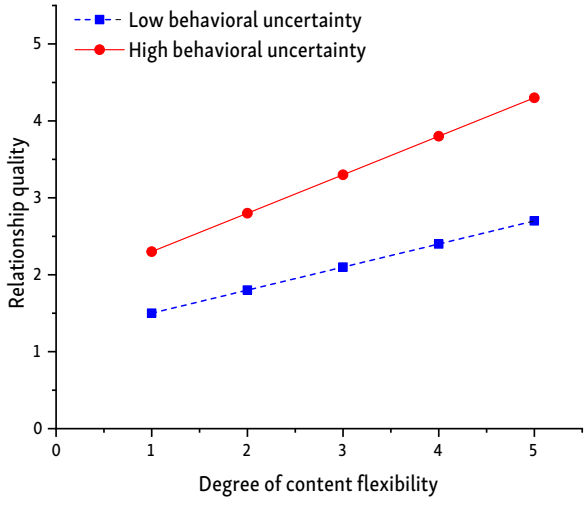

Figure 4. Graphical moderating representation of behavioral uncertainty

In addition, as depicted in Table 4, the relationship quality is influenced by four control variables. Project complexity, and project duration are negatively related to relationship quality. The results show that the greater the complexity and duration of the project, the greater the impact on the quality of the relationship. In contrast, both prior collaboration experience and the expectation of continuity are positively related to relationship quality which implies that prior collaboration experience is conducive to the formation of high relationship quality, and the expectation of continuity can maintain the relationship quality.

6. Discussion and conclusions

6.1. Major findings

Contractual flexibility in project management represents an important capacity for parties to maintain and enhance relationship quality. This study adds to our understanding of when contractual flexibility matters to relationship quality under different attributes. This study distinguishes content and executing flexibility, and our research contributes to this literature by demonstrating (1) the positive value of both forms of contractual flexibility; (2) the distinct implementation process associated with each form of contractual flexibility – simple and well-regulated for content flexibility and rely on the relationship for executing flexibility – reconciles prior views on when contractual flexibility may become more or less effectual and (3) three boundary conditions, asset specificity, environmental uncertainty, and behavioral uncertainty, which influence the effectiveness of content flexibility and executing flexibility in opposing ways.

The results for H1a and H1b show that distinguish from content flexibility, contractual executing flexibility has a more positive impact on relationship quality in this study. Content flexibility may not always align seamlessly with project execution. In some cases, at least one partner may perceive their benefits as being compromised when adjustments to costs and benefits are made based on the initial contract (Fehr et al., 2015; Feng et al., 2023). If the parties fail to reach an agreement on the adjustment outcomes, relationship quality could decline. Such situations may lead to increased transaction costs due to opportunistic behavior or the need for renegotiation (Yoon & Yu, 2019). Therefore, incorporating flexibility into the contract through execution flexibility, guided by well-defined policies or relational capabilities, can help mitigate these challenges. In the life-cycle project management process, the implementation or execution of the contract requires flexibility and mechanisms for change (Feng et al., 2023). Executing flexibility reflects the trust for partners' capacity and cooperation relationships, which helps the partners work together to respond to risks according to reality and adopt cooperative behavior in the project process. Content flexibility responds to unforeseen events rapidly and reduces transaction costs. Executing flexibility is used as a remedial measure to make up content flexibility through good communication and risk allocation.

More pointedly, for content flexibility, we argue that transaction characteristics of asset specificity and environmental uncertainty threaten the relationship quality (H2a, H3a). In contrast, for behavioral uncertainty, its accuracy augments its value to enhance relationship quality (H4a). In contrast, executing flexibility has a stronger effect on performance in the presence of asset specificity, environmental uncertainty, and behavioral uncertainty (H2b, H3b, H4b). The analysis results support these hypotheses above.

The test of H2a and H2b examined the moderating role of asset specificity on the relationship between contractual flexibility (content flexibility and executing flexibility) and relationship quality. Consistent with prior studies (Lui et al., 2009), asset specificity negatively moderates the relationship between content flexibility and quality induced. Even though rewards and punishments exist in content flexibility in order to restrain asset specificity, incentives are misaligned because not all partners are bound by sunk costs at the same level. Regarding executing flexibility, the empirical result support H2b, indicating that asset may foster relationship quality through executing flexibility. In this condition, parties are committed to working together to fully utilize the specialized investment, rather than simply taking advantage of it (Yen & Hung, 2017). The moderating effects are contrary to the traditional perspective. Contractual flexibility emphasizes that the relationship between the parties is cooperation and coordination, rather than confrontation. Consistent with the moderating effect described in Figure 2, content flexibility works better when asset specificity is low, whereas executing flexibility is more effective when it is high.

The test of H3a and H3b examined the moderating role of environmental uncertainty on the relationship between contractual flexibility and relationship quality. The result supports H3a, which indicates that environmental uncertainty negatively moderates the relationship between content flexibility and relationship quality. When the environmental uncertainty is high, the framework constructed based on content flexibility may be unfair or ineffective, at least one partner will feel his benefit is damaged, and the relationship quality will be declined. However, environmental uncertainty has a positive moderating effect on the relationship quality induced by executing flexibility. Fehr et al. (2015) claimed that contract revision is a more nuanced process than the previous literature has recognized. Thus, parties should draft a straightforward contract initially and make adjustments afterward if needed, instead of attempting to predict and incorporate all potential future contingencies into a flexible contract from the beginning (Feng et al., 2023). Based on the above, the parties will solve the problems caused by uncertainty by executing flexibility. Execution flexibility uses trust, commitment, and communication to face environmental uncertainties during contract implementation, enhancing the relationship quality, thereby avoiding performance shading and achieving

consummate performance. Consistent with the moderating effect described in Figure 3, the results indicate that content flexibility is more effective when environmental uncertainty is low, whereas executing flexibility works better when it is high.

The test of H4a and H4b examined the moderating role of behavioral uncertainty on the relationship between contractual flexibility and relationship quality. The hypothesis H4a is supported, which means that when the behavioral uncertainty is higher, the relationship quality will be higher through content flexibility. Once unexpected contingencies occur, all partners have little accurate and reliable information about how to address them (Krishnan et al., 2006). Consequently, a penalty, enforcement, and incentive system based on content flexibility can threaten and motivate the partners, the party's final output can be evaluated, and rewards and sanctions can be effectively applied, which leads to the partners behaving well. According to Poppo et al. (2008b), even though their behavior is difficult to measure, content flexibility minimizes the risk of misconduct and drives greater performance by aligning rewards and punishments with outcomes. Thus, when behavioral uncertainty is severe, the relationship between the parties may need to be bolstered by other important correlates, such as trust and reputation (Zwikael & Smyrk, 2015).

6.2. Theoretical contributions

This study significantly contributes to understanding contractual flexibility and TCE (Transaction Cost Economics) in the construction industry in several ways. It extends TCE to analyze the impact of contractual flexibility on parties' relationship quality in construction projects, and most literature used asset specificity, environmental uncertainty, and behavioral uncertainty as antecedent variables of contract designing (Fink & Harms, 2012; Abdi & Aulakh, 2017), this study considers transaction attributes can also be moderating variables of contractual flexibility and exclude the endogenous problems. Finally, five boundary conditions are confirmed to influence the effectiveness of contractual flexibility.

Overall, our findings challenge the assumption that contractual flexibility is always positive to relationship quality from transaction attributes, and may clarify some seemingly conflicting findings by showing it is necessary to match transaction attributes with the type of contractual flexibility. This research fills the gap by dividing contractual flexibility into content flexibility and executing flexibility, and assessing the relative magnitudes of the effectiveness of transaction attributes in projects. The results highlight that when asset specificity or environmental uncertainty is high, executing flexibility, not content flexibility, matters more to relationship quality. In contrast, when behavioral uncertainty is high, content flexibility, not executing flexibility, matters more to relationship quality. These findings suggest that managers should incorporate executing flexibility into contracts more sufficiently, and the appropriate contractual flexibility should match a certain degree of transaction attributes.

6.3. Managerial implications

Our results highlight the importance of establishing efficient contractual flexibility for good relationship quality. Content flexibility and executing flexibility are distinct constructs with different logic and decision rules, and they both matter to relationship quality. In addition, this study also cautions against relying too narrowly on content flexibility, as executing flexibility matters more to relationship quality than content flexibility. As evidenced by our results, many construction companies have sought to reduce transaction costs by focusing on their most important partners because they can develop a shared "identity" with partners, or more practically, a shared, bilateral vision and purpose. Our findings emphasize the necessity of executing flexibility when asset specificity and environmental uncertainty exist, as well as the critical role of content flexibility when behavioral uncertainty exists. As contract managers have understood how transactions moderate the effect between contractual flexibility and relationship quality, content flexibility and executing flexibility should match the attributes. To promote the effectiveness, contractors should establish the evaluation system to measure the transaction attributes. They could decide the optimum flexibility application ways or adopt different types of contracts. The challenge in achieving executing flexibility lies in the parties' tendency to only focus on meeting the minimum requirements outlined in the contract, rather than striving for excellence through non-contractual actions. Therefore, the key to achieving execution flexibility is to incentivize parties to deliver consummate performance, ultimately enhancing relationship quality and generating additional value for the project.

6.4. Limitations and further research

This paper has several limitations that provide directions for future research. First, although this research controlled for project complexity and duration, the possible heterogeneity between different samples had not been completely eliminated. Different industries, cultures, and institutional environments have different effects on the execution of contractual flexibility. Future research should use broader samples to generalize the findings and conduct a comparative analysis. Second, relationship quality changes over time, particularly at different stages of the construction project (Xue et al., 2023). However, these construct and transaction attributes are also measured after the project, so that the analysis results reflect the relationship among the constructs in a certain extent. A longitudinal study is encouraged to understand their dynamic functions more comprehensively.

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APPENDIX

Table A1. Measurement scales and validity assessment

Construct and measuring items	VIF	SFL
Content flexibility: α = 0.918, AVE = 0.521, CR = 0.929		
1. For unexpected contingencies, the contract terms set up the corresponding price adjustment mechanism.	1.246	0.720
2. For unexpected contingencies, the contract terms design the principle of price adjustment.	1.673	0.709
3. The initial contract price can be adjusted according to the future risks or contingencies.	1.934	0.664
4. Facing unexpected contingencies, renegotiation is permitted according to contract terms.	2.021	0.680
5. The contract terms design a series of flexible and quick renegotiation procedures.	1.944	0.744
6. The contract terms design the renegotiation mechanism for a wide range of unforeseen events.	2.455	0.737
7. The contract terms design feasible dispute-settlements mechanism.	1.276	0.756
8. The contract terms design, as complete as possible, solutions for potential disputes.	1.352	0.703
9. The contract terms design a series of flexible and quick procedure of disputes settlements.	1.345	0.754
10. The contract terms link incomes to the final project performance.	1.448	0.721
11. The contract terms design a flexible incentive mechanism for risks response.	1.871	0.763
12. The contract terms design corresponding incentive measures for various performances.	1.276	0.733
Executing flexibility: α = 0.830, AVE = 0.543, CR = 0.877		
1. During the contracting, the contract itself is not so important.	1.782	0.780
2. During the contracting, the contract content is executed strictly (Reverse coded).	1.635	0.801
3. During the contracting, informal agreements are equal or more significant as formal contracts.	1.264	0.753
4. During the contracting, we have certain right of independent administration to risk response.	1.873	0.703
5. During the contracting, the cooperative relationship is able to deal with changes flexibly.	1.635	0.613
6. During the contracting, we can adjust the initial contract to respond to changing environment.	1.385	0.764
Asset specificity: α = 0.856, AVE = 0.698, CR = 0.902		
1. If we had to switch to a different contractor during the project, much of our investment in resources (such as human, equipment, or materials) would have to be made again.	1.399	0.880
2. If we had to switch to a competitive contractor during the project, it would be difficult for us to recoup investments in resources (e.g., human, equipment, or materials).	2.325	0.860
3. If we had to switch to a different contractor during the project, it would take some time for us to bring the new contractor up to adapt to the construction schedule.	1.586	0.794
4. We have spent a lot of time and effort learning to work effectively with the contractor before our relationship was productive.	1.374	0.806
Environmental uncertainty: α = 0.827, AVE = 0.545, CR = 0.893		
1. The project's external environment (e.g., politics, economics, & natural conditions) is unstable.	2.132	0.890
2. Predicting the future environmental condition is a real problem in the project.	1.384	0.772
3. Parties' requirements or preferences change quite a bit due to environment changing frequently.	1.378	0.907
Behavioral uncertainty: α = 0.835, AVE = 0.632, CR = 0.696		
1. Only depending on submitted reports makes it difficult to evaluate whether this party follow established procedures.	1.632	0.890
2. To obtain a satisfactory assessment of this party's performance, we need to conduct on-site inspection.	1.322	0.772
3. Evaluating the performance of this contractor requires extensive inspection and great efforts.	1.882	0.907
Relationship quality: α = 0.967, AVE = 0.910, CR = 0.976		
1. There is a lot of trust between my company and other partners in the project.	1.237	0.949
2. There is good commitment between my company and other partners in the project.	1.364	0.959
3. There is great teamwork between my company and other partners in the project.	1.992	0.959
4. The project performance is satisfied.	1.623	0.949
Prior collaboration experience: α = 0.863, AVE = 0.702, CR = 0.943		
1. I have had multiple collaborative experiences with this partner.	1.232	0.864
Expectation continuity: α = 0.858, AVE = 0.823, CR = 0.772		
1. I anticipate continuing to collaborate with this partner in the future.	2.027	0.853
Project duration: α = 0.824, AVE = 0.761, CR = 0.901		
1. The project requires sustained cooperation over an extended period due to its relatively long duration.	1.323	0.799
Complexity: α = 0.802, AVE = 0.705, CR = 0.743		
1. The project had a high degree of complexity concerning task content.	1.726	0.848
2. The project was characterized by high risk and uncertainty.	1.953	0.811
3. The project had a high degree of complexity concerning interdisciplinary participants.	1.468	0.863

Note: SFL = standardized factor loading, α = Cronbach's alpha, AVE = average variance extracted, CR = composite reliability, VIF = variance inflation factor.